



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of: Drake et al.	§	Examiner: Hughes, Scott A.
	§	
Filed: April 1, 2004	§	Art Unit: 3663
	§	
Serial No.: 10/816,510	§	Attorney Docket No.: 2003UR021
	§	
Title: Method for Improved Bubble Curtains for Seismic Multiple Suppression	§	Confirmation No.: 8615
	§	

**AFFIDAVIT**

STATE OF TEXAS §

COUNTY OF HARRIS §

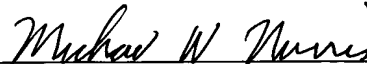
Before me, the undersigned authority, personally appeared **Michael W. Norris**, who, being by me duly sworn, deposed as follows:

1. I, Michael W. Norris, am an employee of ExxonMobil Upstream Research Company. I believe that I am an expert in the field of marine seismic data acquisition. I have a B.S. in Electrical Engineering from Louisiana Tech University, and 33 years of experience working in areas that included the field of marine seismic data acquisition during which time I have encountered, observed and operated marine air guns as seismic sources. From 1972 until 1999, I worked for Western Geophysical Inc., a leading seismic data acquisition contractor to the petroleum industry. In 1996-97, I worked on a distributed air gun source which used multiple air guns to create long duration, pseudorandom source signatures for marine acquisition. I currently am a Senior Acquisition Specialist concerned with methodologies and technologies associated with marine and land seismic data acquisition. As part of this work I am concerned with impulsive and extended duration marine sources. I am a named inventor on the following U.S. Patents:

US 5,623,455, "Apparatus and method for acquiring seismic data;"  
US 5,724,241, "Distributed Seismic Data-gathering System;"  
US 5,920,828, "Quality Control Seismic Data Processing System;"  
US 5,996,709, "Projectile assisted drill for seismic operations;"  
US 6,002,339, "Seismic synchronization system;" (GB2333841)  
US 6,148,952, "Hydraulic Slotted Cylinder as a Seismic Source;"  
US 6,154,420, "Seismic Streamer Trim System;"  
US 6,244,375, "Systems and Methods for Performing Real Time Seismic Surveys;"  
US 6,288,972, "Cleated Boot Coupling Device;"  
US 6,490,529, "Method for Customizing Seismic Explosives;"  
US 6,662,899, "Use of autonomous moveable obstructions as seismic sources;"  
US 6,712,141, "Method and apparatus for deployment, mounting and coupling of downhole geophones;"  
US 6,736,213, "Method and system for controlling a downhole flow control device using derived feedback control."

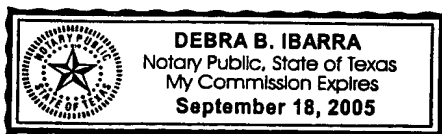
I have authored/co-authored EDGER Forum workshop, December 2003, presented "OBC Signal Fidelity Analysis;" and EAGE Research Workshop September 2004, "OBC Signal Fidelity", Marvin L. Johnson, Mike W. Norris, Mat Walsh, September 2004.


2. I have read the attached excerpt from the Applicants' response to the Office Action mailed on July 12, 2005. I agree with all arguments and opinions expressed therein, and with the conclusion that the device illustrated in Fig. 1 of the subject application would not be suitable for use as a seismic air gun.



Michael W. Norris

Sworn to and subscribed before me this 31<sup>st</sup> day of August, 2005.



  
Debra B. Ibarra, Notary Public - State of Texas

## **ATTACHMENT TO AFFIDAVIT OF MICHAEL W. NORRIS**

The examiner contends that the apparatus as claimed can be used to practice another and materially different process, in particular functioning as an air gun in a seismic survey. (Presumably one would disable pump 5 or fill chemical additive tank 7 with water? Reference is to Fig. 1 of the present application.) An air gun is (1) a high-pressure device operating typically at 2000 to 2500 psi or more above atmospheric pressure that is (2) used in an impulsive mode whereby a significant portion of a trapped air volume is emitted within a few milliseconds by an opened shuttle/window in the air chamber. The injection of this short duration, high pressure air volume (3) emits a single, very large bubble feet or meters in diameter. See, for example, the attached two pages from the website of the U.S. Geological Survey, including also a marked up copy of the cutaway view to make it clearer what is being depicted. This air gun has four exit ports where a large volume of air is ejected at very high pressure each time the gun is "fired." See also U.S. Patent No. 4,472,794 (see col. 2, lines 52-54 describing a prior art air gun design operating at firing chamber pressures in the range 3,000 to 5,000 psi), or visit the website of Bolt Technology, Inc., a leading manufacturer of air guns: [http://www.bolt-technology.com/Marine\\_Air%20Guns\\_Title\\_Page.htm](http://www.bolt-technology.com/Marine_Air%20Guns_Title_Page.htm). A copy of Bolt's website page is enclosed herein. The rating of the various air gun models in terms of cubic inches refers to the volume of the air gun's chamber, where air is pressurized before "firing." None of the photographs or drawings show exact dimensions of the ports, but clearly they are not the "micropores located at intervals along hose 1" as described in paragraph 29 of the present application in conjunction with Fig. 1, openings too small and numerous to be shown in Fig. 1. Applicants have amended claim 1 to more precisely reflect this feature of the present invention, so different from an air gun. A myriad of tiny bubbles continuously fizzing from the pores of a flexible hose as compared to a huge single bubble blasted out of the 2-4 ports of a high-pressure device made of steel each time the air gun is fired.

Claim 17 has been further amended herein to limit its diffuser to a hose made from polymeric or elastomeric material (as in original claim 6). Such a diffuser would not be able to withstand the pressures required for air gun seismic operations, which extend up into the thousands of psi as noted above. In fact, the present device

has no means to contain the pressure while the pressure builds up for a single impulsive blast needed for seismic work. An actual air gun has a valve that seals the air chamber during pressure buildup. The present device has no such valve and in fact has no suitable air chamber. To be used as an air gun, the "Y" conduit (see ¶ 30) would need to serve as the air chamber. It would have to be pressurized by a compressed air source 13, and as the pressure builds up, the walls of the "Y" conduit would have to be able to withstand the pressure, including the plug 9 suggested as being epoxied to that end of the "Y." Furthermore, a valve would have to be retro-fitted to seal off the diffuser hose 1 from the rest of the "y" conduit serving as the pressure buildup chamber. (Reference is to Fig. 1 of the present application.) Hence, the present device is not capable of acting in the short duration, pulsed mode required for seismic prospecting. If a valve were retro-fitted to the present device, it would still be able to emit only a very small impulsive acoustic signal because the claimed diffuser would have a burst pressure on the order of about 100 psi, which is far too low in energy to be of use as a seismic source. Air guns need to be capable of repeated firing without replacing an exploded part after each shot. Even if the diffuser was capable of containing high pressure air, the total flow rate for the diffuser would not allow sufficient energy to be transferred to the water to create a seismic air gun signature.